The Integrator

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Message from the Transition Manager

This latest edition of our newsletter found our reporters and contributors providing news on exciting areas within and external to the Space Network. Therefore, you will notice our subtle name change to "The Integrator." We've expanded our initial focus from the Space Network to include other areas of interest to the Networks community. There are articles related to the Ground Network and also a new section highlighting evolving technologies. Many thanks to all the people who wrote and contributed information for the articles.

A major milestone occurred on March 10, 1995, with the White Sands Ground Terminal/NASA Ground Terminal (WSGT/NGT) decommission. I'd like to express my thanks to all of those who made the decommission possible. The decision to shut down WSGT/NGT was made with confidence due to the operational success of Danzante. Now the Cacique Upgrade project is well under way and I am confident that we will soon have another highly successful ground terminal. Thank-you for your continued support, it is greatly appreciated.

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White Sands Complex

Danzante (STGT) Continues to Perform at the Top

Danzante (the Second TDRS Ground Terminal (STGT)) has greatly exceeded the progress records of the original TDRS support facility at the White Sands Ground Terminal (WSGT). White Sands Complex (WSC) personnel have directly contributed to the site's progress by resolving numerous engineering, operational, and software "teething" problems, in addition to performing their normal operational duties.

The success of the Danzante project is impressive. Danzante, in its first six months of operations, has:

- Posted an eleven day period of 100% operational proficiency.
- Exceeded a monthly proficiency rating of 99.9%.
- Provided STS support with a proficiency rating of 99.95%.
- Established a comprehensive in-house training program that has greatly reduced the reliance on costly vendor training.
- Significantly reduced the need for expensive Return-to-Vendor maintenance.
- Completed full Security Certification.
- Established an in-house, on-line, Mission Operations and Data Systems Directorate (Code 500) technical library.
- Passed its first Annual Safety Inspection.

Danzante demonstrated its comprehensive ability to control every aspect of both present and scheduled TDR Spacecraft.

Danzante successfully maneuvered both the F1 and F3 TDRS, without a flaw. Danzante personnel have completed formal, classroom training on the new F7 TDRS and will receive reinforcement training, via simulations, until the launch of F7. The F7 simulations have proven that Danzante's personnel and systems are fully ready to support F7 operations. F7 launch support will be provided by the Extended TDRS Ground Terminal (ETGT) segment of WSC whose personnel and systems have also fully demonstrated their ability to perform the required tasks.

The WSC engineering department deserves special recognition for its support in the key areas of the High Power Amplifiers (HPAs), technical expertise on the Integrated Receiver (IR), and support of new projects. The development of Engineering Changes (ECs) for and maintenance of the HPAs is now an in-house capability. Three major ECs have been provided for the HPAs to-date, which have resulted in significant reductions in operational costs and increases in operational reliability.

WSGT/NGT Decommission Occurred on March 10, 1995

WSC engineers have established a formidable in-house technical capability to develop, test, and

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Danzante - Top Performer

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deliver firmware up-grades for the IR. The in-house expertise was proven when WSC engineers detected a flaw in the latest vendor-delivered firmware upgrade for the IR, developed a fix for the flaw, and delivered the corrected firmware. The engineering department is aggressively expanding the performance of the IR by developing firmware upgrades which will allow Danzante to support Centaur and IUS launches.

Danzante's growth potential and in-house engineering/software capability have also been demonstrated by the successful support of the NASA STARLink Project. Implementation and integration of the STARLink interface is proceeding without any major problems experienced to-date.

Danzante's proficiency ratings are even more impressive when it is considered that Danzante has been providing between 2,500 and 4,000+ hours of customer forward and return support for every month since January 1995. A site party was held in celebration of achieving numerous historic milestones and a new goal set for fourteen days of 100% proficiency! The trend in proficiency ratings is positive and site personnel are looking forward to posting a monthly proficiency of 100%.

Article by Doug Perkins

Building Cacique Upgrade

The Cacique ground terminal (formerly known as WSGT/NGT), which supported the Space Network (SN) for ten years, was decommissioned on March 10 after successfully completing the Decommission Readiness Review (DRR) on March 1. Cacique Upgrade has made significant progress since the decommission. Most of the equipment has been removed and the general construction subcontractor, Gardner Zemke (GZ), has initiated Phase II of the project. The strong efforts made by NASA, Lockheed Martin, GTE, ATSC, and their subcontractors have been reflected by staying on schedule to meet the initial equipment installation milestone in July despite an aggressive timetable.

Secure equipment was declassified after the decommission and all of the equipment in the old ground control equipment (GCE) room was immediately removed. GZ began to systematically remove walls, floors, and the internal contents. The infamous "Wall," which separated the WSGT and NGT, was also removed to accommodate the new GCE room. Also, a continuous power supply was established to the TDRS Launch and Deployment Control Center (TLDCC) to support the upcoming TDRS-G(F-7) launch.

The 18.3 meter antenna refurbishment that started last January was completed in March. An 18.3 meter antenna retrofit, which includes replacing the antennas' azimuth and elevation drives and related control equipment, commenced immediately after the antenna refurbishment and is expected to be completed in late October. Other upgrade activities are being conducted in parallel to the Phase II Construction. The Control and Display Computer Network (CDCN) equipment has been inventoried in preparation for the setup and configuration of the clusters. The tunnel waveguides have been tested and will be retained for reuse in the upgraded ground terminal. Rooftop antennas (e.g., GPS, WWV, Loran, and MA emitters) are being installed over the next three months.

After equipment installation is completed in September, Level 5 testing is scheduled to begin. Level 5 testing will consist of local medium and long loop tests on SGLTs 4 and 5. Consequently, SN customers and elements will not be asked to participate during this time. Level 6 Testing will consist of interface testing as well as a full two TDRS loading demonstration with actual SN entities participating. Customer modules that are not tested during Level 6 Testing will be run during Post-Level 6 Testing.

Despite the Cacique Upgrade challenging schedule, the project participants have made significant progress on the ground terminal. Critical tasks that lead to the initial installation of the tunnel waveguide equipment on July 10 are on schedule. Several tasks, such as the GCE/TOCC cable bundling, are ahead of schedule. The following are significant milestones for the Cacique Upgrade Project:

March 10, 1995 WSGT/NGT Decommission and equipment removal
April 3 Began Phase 2 construction
July 10 Start installation in tunnel entrance room & tunnel
July 24 Start installation in the TOCC and GCE rooms
September 6 Start Level 5 Testing
January 9, 1996 Start Level 6 Testing
March 24 Cacique Upgrade 2 SGLT Station Acceptance

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Cacique Upgrade

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March 26 Start SGLT-6 installation
April 1 Start Post-Level 6 Testing
April 24 Initial 2 SGLT SN Operations
Summer Start White Sands Complex (WSC) Dual Station Operations

For additional information, please contact Tom Gitlin

TDRS Update

What is the Status for TDRS-H,I,J?

A contract was awarded to Hughes Aircraft Corporation of El Segundo, California for development of the TDRS-H, I, J Tracking and Data Relay Satellites and associated ground segment modifications. The contract was signed on February 22, 1995 to become effective on April 3, 1995. A protest to that award was filed by TRW with the General Accounting Office (GAO). The GAO is currently processing the TRW protest.

Article by Larry Zeigenfuss

Network Control Center (NCC)

NCCDS Release 95.1 is on the Floor

NCCDS Release 95.1 was successfully completed in May 1995. The success of this release was due to valuable cooperation and support from NCC personnel, Customers, and Elements. This release completes the NCC Block 3 program which began in 1989. Release 95.1 achieves the NCC requirements for the upgraded White Sands Complex as well as the capability to provide customer services from more than three TDRS.

Release 95.1 Acceptance Testing, including Engineering Interface (EIF) testing, was completed successfully in May, followed by an Operational Readiness Review, and the May 19 cutover to operations.

Article by Lynn Myers

Designing the Service Planning Segment Replacement (SPSR)

Progress is continuing on the Service Planning Segment Replacement (SPSR) development effort for the NCC. The goal of the SPSR is to effectively meet future demands on the Space Network by upgrading NCC technology and to reduce system maintenance costs by utilizing off-the-shelf (OTS) technologies whenever practicable. The new system will increase resource scheduling efficiency, increase automation and minimize human conflict resolution, replace proprietary mainframe computers with open systems workstations, improve scheduling software maintainability, and increase customer satisfaction in meeting mission needs.

SPSR
Preliminary Design Review – June 29, 1995
Critical Design Review – November 1995

Currently in the design phase, the team is conducting trade studies of OTS hardware and software technologies and approaches in the areas of object-oriented design and programming, distributed systems, data base management, and graphical user interface (GUI), as well as resource scheduling. Trade study evaluations of commercial and public domain software packages are currently on-going.

Tentatively, the architecture of the SPSR will be a distributed system using several UNIX-based workstations. The system will provide schedulers with a GUI based on the X Window System, the Open Software Foundation's (OSF's) Motif user interface style, and the Common Desktop Environment (CDE). Current plans are to utilize a commercial, relational database management system (DBMS) such as Oracle or Sybase, with a COTS object-oriented interface library. Though still a relatively immature technology, a COTS Common Object Request Broker Architecture (CORBA) system, is planned which will provide for distributed, asynchronous program objects. With application-specific software to be implemented in the C++ programming language, commercial class libraries will be used for utility and GUI software components. A variety of scheduling algorithms are being evaluated for use with the scheduling engine.

Software development is scheduled to begin on a small scale in September and in earnest in December. A Preliminary Design Review is scheduled for June 29 and a Critical Design Review in November. Customers are invited and encouraged to attend the design reviews.

For additional information, please contact Jay Costenbader

Space Network Elements

Nascom Plans for Cacique Upgrade

The prime broadcast and 50 Mbps Statistical Multiplexer (SM) carrier will be transitioned from the carrier's earth station to Cacique Upgrade (WSGTU) beginning in September 1995. This transition must be completed by January 1996 to support Level 6 testing. A phased approach will be followed to minimize carrier downtime and maximize Cacique Upgrade test time. Minor interruptions to services are expected and customers will be provided additional details as the transition approaches. During the first phase, Danzante prime broadcast customers will be switched to the alternate broadcast system while Cacique Upgrade is spliced into the fiber optic cable that connects Danzante to the prime broadcast earth station. Broadcast services will be uninterrupted, however 50Mbps SM services will have a scheduled downtime during this transition. The second phase will occur following testing of the connections between Cacique Upgrade and the prime broadcast earth station. This will allow for the physical relocation of the carrier equipment to its permanent location at Cacique Upgrade. Once again the Danzante prime broadcast customers will be switched to the alternate broadcast system and the 50Mbps SM services will have a scheduled downtime during the transition. Upon the completion of this phase, the WSC will be in its final configuration for common carrier services.

Two new Digital Matrix Switches (512 x 512) are also scheduled for delivery to Nascom this summer. The DMSs, which provide a switching capability between the MDM system and GSFC customers, will be tested and installed around the forthcoming Shuttle mission freezes. The first switch will replace an existing, aging switch in the Nascom network. The operational role of the second switch is to be determined.

Article by Betsy Forsbacka

All Systems Normal at Flight Dynamics Facility (FDF)

The Flight Dynamics Facility (FDF) continues to support Danzante operations with no problems, and the Space Network is performing nominally. The FDF participated in EIF testing for NCC Release 95.1 in February, in preparation for the May cutover. FDF personnel also supported the Decommission Readiness Review for WSGT and NGT that was held at the White Sands Complex in March 1995.

Article by Sue Hoge

User Planning System (UPS) Enhances Customer Support

The User Planning System (UPS) Release 8, Build 0, Version 2 is now fully operational. UPS Release 8 was delivered to acceptance test in October 1994 and was placed in operations at MSOCC on April 13, 1995. UPS Release 8 corrects 37 Discrepancy Reports (DRs), implements 26 Enhancement Requests (ERs), migrates to a more recent release of the Oracle database management system, and upgrades the UPS gateway (front-end). A patch Release (Version 3) will be delivered to acceptance testing on June 15, 1995 and will be distributed to all UPS customers as soon as testing is complete. The patch Release corrects minor discrepancies and provides additional enhancements critical to the X-Ray Timing Explorer project.

Changes to the UPS to function with the new capabilities of the SPSR are in work and include Flexible Service Requests (FSRs) and TDRS Free Time capabilities. FSRs are used by customers to specify flexible tolerances in scheduling network services. The TDRS Free Time capability will provide the NCC the capability to transmit to the MOCs available TDRS resource windows by service and duration. Available services could then be scheduled on a first-come first-serve basis. These capabilities are being implemented in conjunction with the NCC's SPSR Project. The operational target date for this release is 1998.

Article by Les Wentz

Packet Processing Facility (Pacor) II Soon to Support Customers

The Packet Processor (Pacor II) Data Capture Facility (DCF) project in the Information Processing Division (IPD) has been busy improving operations for science data processing. Release 2.2 was delivered in May to operations. This release contains enhancements to support the X-Ray Timing Explorer (XTE), Solar and Heliospheric Observatory, Submillimeter Wave Astronomy

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User Planning System

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Satellite, and the Hubble Space Telescope (HST). XTE will be the first mission to use the Pacor II system. Release 3.0, planned for late this year will add enhancements to allow support of the Tropical Rainforest Measuring Mission (TRMM) spacecraft.

The major improvement in Pacor II over previous data processing systems is in the operations area. The same high quality of data will be maintained, but will require less manpower and improve the processing speed. The goal of the Pacor II program is to consolidate and simplify current operations. Newer technology is being used in the operations area; Sun workstations will replace the current super mini-computers and a TCP customer interface has been implemented. The enhancements will allow the HST Science Institute to receive data in real-time and reduces many labor intensive processes.

The Pacor II project received approval in January 1992 and had an early version of the system running in November 1993 to "help get everyone up to speed." Additionally, the Network Test and Training Facility (NTTF) is in the process of developing a multi-media training package to facilitate operations training on the system

Pacor II has been involved in extensive testing since the early 1995 release, participating in data flow tests with each of the mentioned spacecraft. This testing has included interface tests with the NCC. Most recently, the IPD completed a four month long integration test effort where Pacor II, the Data Distribution Facility, and other IPD support elements were put through their paces and declared "ready for operations."

For additional information, please contact Eve Rothenberg

Space Network Customers

Extreme Ultraviolet Explorer Celebrates Anniversary

As we celebrate our three-year anniversary (June 7), the Explorer Platform and its scientific payload, Extreme Ultraviolet Explorer (EUVE), continue to perform very well. The project continues to be very satisfied with the support received from Danzante. We are currently preparing the test modules for the Level 6 testing with the Cacique Upgrade.

The Flight Operations Team (FOT) has begun the transition from the current Multi-satellite control center environment to the newer Transportable Payload Operations Control Center (TPOCC) environment. Parallel mission operations will commence in early July with the delivery of Release 1. Two subsequent deliveries are anticipated prior to final transition in January 1996. We hope for this transition to be transparent to the network, but we ask for patience in the event of operational problems.

Space Network User's Guide
Available electronically for review and comment
Comments due by the end of July 1995
For information, contact:
Sam Raimond at 301-805-3090

Additionally, the FOT will enter the extended phase of mission operations on July 15. In the extended mission, the project will be supporting the Mission Technology Testbed program which will utilize up to 25% of mission time for the validation and flight testing of new technologies. The FOT will also be involved in the development of a computer-based system capable of conducting certain aspects of routine flight operations in an autonomous manner. We are looking forward to a very exciting and challenging second half of 1995.

Article by Ken McKenzie

Hubble Space Telescope Prepares for Instrument Replacements

The Hubble Space Telescope (HST) continues to prepare for the Second Servicing Mission, scheduled for February, 1997. In May, the HST Program and Project managers determined the following primary activities for the mission: 1) replace the Goddard High Resolution Spectrograph (GHRS) with the Space Telescope Imaging Spectrograph (STIS), 2) replace the Faint Object Spectrograph (FOS) with the Near Infrared Camera/Multi-Object Spectrograph (NICMOS), 3) replace Data Interface Unit #2 with a new unit, and 4) replace Mechanical Tape Recorder #2 with the spare Mechanical Tape Recorder. Secondary activities will include: 1) replace Mechanical Tape Recorder #1 with a new Solid State Recorder, 2) replace Rate Sensing Unit #3/Electronic Control Unit #3 with a Hemispherical Resonator

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HST Service Mission

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Gyro unit and J-Box, 3) replace Rate Sensing Unit #1 with a spare yRate Sensing Unit, and 4) replace Solar Array Drive Electronics #2 with the flight spare. A decision on replacing a Fine Guidance Sensor will be made in August of this year after further analysis.

In May, the HST (Wide Field Planetary Camera II (WF/PC-II) was used to obtain images of Saturn's rings when they were edge-on to the Earth. The objective was to detect an "Oxygen/Hydrogen (OH) atmosphere" associated with the rings. Different filters were used to discriminate between dust and OH emission, and to subtract scattered light. These observations will be used to determine exposure times for a later series of ring-plane crossing observations in August.

HST engineers are preparing TDRSS event modules for Cacique Upgrade Level 6 and Post-Level 6 testing. These modules will be used to construct test cases. The NCC transitioned to the NCCDS Release 95.1 software delivery in May, with no impact to HST operations. NCCDS Release 95.1 allows the NCC to support up to 10 TDRS vehicles with either standard or longitudinal designators. HST's software changes for the added functionality have been delivered to Goddard and will be tested this summer internally and with the NCC.

Article by Barbara Pfarr

Upper Atmosphere Research Satellite Explores Power Options

The Upper Atmosphere Research Satellite (UARS) is currently being operated with the solar array fixed near the 300 degree position due to difficulties experienced recently in rotating it at the orbital rate. Because of this situation, four instruments on board are collecting science data: the Halogen Occultation Experiment (HALOE), Active Cavity Radiometer Irradiance Monitor II (ACRIM II), Solar Stellar Irradiance Comparison Experiment (SOLSTICE), and Solar Ultraviolet Spectral Irradiance Monitor (SUSIM). The short-term plan is to continue operations in this mode while various options are explored regarding the array and power subsystems.

Danzante continues to support UARS communications proficiently. The UARS Flight Operations Team participated in the WSGT/NGT Decommission Readiness Review in March 1995, and looks forward to participating in testing of the Cacique Upgrade.

Article by Erik Berger

The Space Shuttle Programs Opens its New MCC

The Johnson Space Center (JSC) is entering a new era in manned spaceflight operations. With the implementation of two new initiatives, JSC hopes to reduce overall costs while improving the efficiency of operations. The first initiative involves reorganizing the infrastructure of the NASA Civil Service and contractor responsibilities. The second major change is a transition from the 1960's era Mission Control Center to a new, modular multifunctional Control Center.

The JSC Mission Operations Directorate (MOD) is proceeding with restructuring itself as part of the reinventing of government initiative. JSC will implement Completion Form Contracting and eliminate Level-of-Effort Contracting by the target date of March 1997. NASA Civil Service personnel will perform the functions of flight operations, operations capability development, training direction, mission processing product development, and resident management of each contractor's major function.

The MOD contractors will perform the standard functions of integrated planning and operations, flight design, flight planning, payload operations integration, mission processing operation, flight software development, training and simulations, and Control Center operations. MOD will institute a clear distinction between NASA Civil Service and contractor responsibilities. This is in contrast to the JSC tradition of blending contractor and Civil Service personnel within MOD.

For the first time since NASA's original Mission Control Center (MCC) was established in 1965, flight controllers plan to work out of the new facility for portions of the Space Shuttle mission in July. The new MCC, developed at a cost of approximately $250 million, eliminates the NASA-unique equipment and massive hardware orientation of the original Mission Control, replacing it with a modular, software-oriented design that uses standard, commercially available equipment.

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New MCC

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The new MCC's design offers unique flexibility in flight control operations, allowing the facility to be changed from controlling a Space Shuttle to controlling any other spacecraft with almost the simplicity of choosing a different function from a computer menu. The commercially available equipment and up-to-date technology used in the new MCC will greatly reduce maintenance

costs for the facility as well. Future Shuttle missions will feature full operations, including launch, orbit, and landing support from the new MCC.

For additional information please contact Joe Aquino

Marshall Space Flight Center Gets a Facelift

Marshall Space Flight Center (MSFC) is currently in the midst of a construction frenzy, with carpenters, electricians, and painters everywhere. Activities are occurring in Building 4663, which houses the Huntsville Operations Control Center (HOSC), Spacelab Payload Operations Control Center (POCC), Data Reduction (DR) and the Spacelab Data Processing Facility (SLDPF). Building 4663 is a tri-winged, two story facility with connecting hallways between the wings. A-wing is generally referred to as the HOSC and contains the Spacelab POCC and the Operations Support Team (OST) control rooms. B-wing is currently empty since the NASA branch that had their offices there moved to a different building. C-wing houses the DR and SLDPF functions.

In A-wing, the new Advanced X-Ray Astronomy Facility (AXAF) Control room is under construction. Construction of the AXAF Action Center and The Technical Support Team rooms has been completed. Construction of the Data Operations Control Room (DOCR) is almost complete and will provide a centralized control room for all of the OST instead of being spread out in three different areas. There is a new single story addition being built onto the west end of the HOSC which will be a dedicated administrative area housing the HOSC Management Staff as well as a significant number of contractor personnel. This new addition is the project nearest to completion (88%) with a Beneficial Occupancy Date (BOD) of June 1st, 1995.

B-wing is undergoing a total gutting and reconstruction to house the new Payload Operations Integration Center (POIC) for International Space Station Alpha (ISSA) along with associated offices and off-line work areas. This area is 55% complete with a scheduled completion date of August 1, 1995.

C-wing is the only area not undergoing any type of construction at this time.

Article by Mike Blum

Long Duration Balloon Program Benefits from Space Network

The LDB Program recently completed payload integration in preparation for a circumglobal balloon flight which is planned for launch from Inuvik, Northwest Territories, Canada in June/July 1995.

Equipment was shipped to Canada in early June and launch operations are scheduled to occur during a June 15 to July 15 time frame. This flight follows a westerly trajectory and terminates over Greenland after thirteen days of flight time during which it flies over Alaska, Russia, and Northern Europe. New LDB Balloon control systems are being tested on this flight in addition to two separate science experiments which are being flown.

During the June flight, GRTS is providing return telemetry on an "as available" basis to its nominal support mission with GN format data to allow the LDB project to assess its feasibility for future balloon missions. Preliminary Interface Event tests had demonstrated the LDB POCC should be able to handle the GN format. This support can provide much needed continuous coverage for balloon missions and may possibly alleviate the SA requirements for future on-board data playbacks when coming out of the TDRS zone of exclusion (ZOE) now covered by GRTS.

A one day test flight was launched from Ft. Sumner, New Mexico on April 1, 1995. This test flight incorporated TDRSS support and was principally executed to verify proper operation of the newly integrated LDB control systems with the existing LDB flight hardware.

The new LDB control systems provide for automated helium and ballast valving control for a recent balloon design called OZP (Over-pressure Zero-Pressure) which is a duct-less balloon having many qualities similar to "super pressure" balloons.

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LDB Benefits From SN

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This design allows better balloon stability, requires less ballast, which in turn allows for heavier science weight budgets and/or longer flights. The April 1 test fight exceeded all the test flight "desired" success criteria.

Two balloon class transponders were recently received by the GSFC RF Systems Section from the manufacturer and were environmentally tested in June. These units are targeted for use on upcoming missions in June 1996 from Inuvik.

Article by Dave Gregory

TOPEX/Poseidon Project Gathers Valuable Science Data on Oceans

TOPEX/Poseidon flight operations continue routinely. Oceanographic data have been taken for over 98 ten-day-long ground track repeat cycles. The Project will celebrate its third anniversary of launch on August 10th.

The eighth orbit maintenance maneuver of the mission was performed on 22 May. These maneuvers are done occasionally to ensure that the spacecraft maintains its ground track with a high degree of repeatability. This guarantees that science data are always taken over the same areas of the Earth's surface. Small propulsive burns – on the order of 3 to 4 mm/sec delta-V – are sufficient to hold the actual ground track within the allowed +/- 1 kilometer control band centered on the required ground track.

All spacecraft operations and Space Network support functions have been routine. Acquisition of data through Danzante has been nominal. It is still necessary for the POCC to apply a 60 microsecond bias to the return channel time delay measurement.

Recent TOPEX data appear to confirm that, at least over the short term, global sea level is rising at a rate of about 1.5 mm/year. However, it is too soon to tell if this is merely a short-term phenomenon or a long-term trend. Investigators at a recent TOPEX/Poseidon science meeting reiterated the need to acquire long data sets (8 to 10 years minimum) before it will be possible to draw meaningful conclusions.

A complete library of TOPEX/Poseidon data dating back to September of 1992 is now available on the World Wide Web. The data are available as image files representing five global measurements taken every three days; dynamic topography, sea surface variability, significant wave height, wind speed, and precipitable water vapor. The files can be found in the "Image/information archives" section of the JPL home page (URL http://www.jpl.nasa.gov).

Article by Terry Adamski

Earth Radiation Budget Satellite Studies the Earth with Other Satellites

The Earth Radiation Budget Satellite (ERBS) continues to perform nominally. The satellite celebrated ten years on orbit in October, 1994, and 10,000 orbits on a single degraded battery in May, 1995. The remaining battery supports the entire spacecraft load, and both the Earth Radiation Budget Experiment NonScanner (ERBE NS) instrument and the second generation Stratospheric Aerosols and Gases Experiment (SAGE-II) instrument continue to collect data.

The ERBS is part of a three satellite constellation, including NOAA F & NOAA G, supporting the Earth Radiation Budget Experiment (ERBE). The ERBE investigates the Earth's intricate balance of absorbed and reflected solar radiation, emitted thermal radiation, and global energy transport. This energy cycle determines weather patterns and shapes our planetary climate. Data obtained from the ERBE instruments have provided atmospheric scientists with quantitative estimates of the global distribution of cloud-radiative forcing, an important factor in climate prediction, and monthly averages of the Earth's longwave and shortwave radiation fields.

The SAGE-II instrument has provided scientists with the first, long-term global monitoring of stratospheric aerosols, including critical ozone data. This data has been used in the study of atmospheric dynamics, ozone chemistry, and ozone depletion. The instrument has also been used to provide detailed analysis of the atmospheric effects of volcanic eruptions. It is the only instrument of its kind in operation.

Transition to Danzante occurred during December, 1994. The Flight Operations Team (FOT) has not experienced any major problems with Danzante operations, and is very pleased with the virtually transparent transition.

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ERBS

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The successful Engineering Interface (EIF) test of NCCDS Release 95.1 was conducted in March, 1995, and the FOT is currently preparing for testing with Cacique later this year.

Article by Rob Bote.
For additional information, please contact R. Sodano, ERBS Project Operations Director, 286-6506

Compton Gamma Ray Observatory

The Compton Gamma Ray Observatory (GRO) continues to perform well in the delivery of significant scientific data. Two extraordinary science highlights from the mission are the discovery of a new class of gamma ray active quasars and the discovery that gamma ray bursts are isotropic over the sky and probably arise from tremendous explosions at the edge of the universe. It is now believed that the gamma ray burst sources are indeed the most energetic phenomenon in the universe. Other major findings include: the detection of atmospheric gamma ray flashes from thunder storms; the detection of nuclear gamma rays from supernova explosions; the mapping of gamma ray emission from our galaxy; and a threefold increase in the number of known pulsars with gamma ray emission, from two to six. GRO continues to produce significant science data.

Article by Billy Breshears.
For additional information, please contact R. Sodano, GRO Project Operations Director, 286-6506

Geostationary Operational Environmental Satellite Achieves Orbit

The Geostationary Operational Environmental Satellite (GOES) - J was placed into nominal orbit on June 1, 1995. This followed a successful launch on May 23 and a series of several apogee burns. GOES-J has been renamed GOES-9 now that it has achieved geostationary orbit. GOES-8 and GOES-9, two new satellites in orbit, mark an important milestone that meteorologists have awaited for quite some time. The design of these satellites allows their sensors to continuously view the Earth. The older generation view the Earth only five percent of the time. GOES-8 and GOES-9 represent a major element of the National Oceanic and Atmospheric Administration"s (NOAA's) National Weather Service's modernization program. The Goddard Space Flight Center Space Network provided early launch support of the spacecraft.

X-Ray Timing Explorer Readies for Launch

The X-Ray Timing Explorer (XTE) continues on schedule for its August 31, 1995 launch on board a Delta-II launch vehicle from the Eastern Range. On May 31, 1995, the XTE was flown from Andrews Air Force Base to Kennedy Space Center (KSC). A spacecraft aliveness test was scheduled for June 5 to begin the KSC Integration and Testing. The next major test of the XTE ground system is an end-to-end test, which will include spacecraft power up, launch, early orbit, and nominal mission day operations.

Since early February, the XTE ground system has completed four major tests with the spacecraft utilizing the Space Network (SN). The SN support has been consistently outstanding for all of these tests. During the second end-to-end test, all of our requested TDRS-East contacts were supported, even during the Shuttle mission. The skill, flexibility, cooperation, and patience of the SN schedulers was evident during testing with the spacecraft in thermal vacuum. Variability of the thermal transitions required multiple re-schedules of TDRS support. The customer-oriented attitude of the SN personnel has been helpful in maintaining XTE's ambitious development schedule.

Article by J.B. Joyce

PORTCOM Follow-up for GLOBE

The Portable TDRSS Communications (PORTCOM) Project is a follow-on to the Global Learning and Observations to Benefit the Environment (GLOBE) Project. Under PORTCOM, enhancements will include higher data rates and voice application. Additional advancement is being considered which would integrate the transmitter and receiver into a single unit as well as the potential for size and power reduction through the use of higher density charge coupled device (CCD) technology.

The GLOBE Project completed fabrication and full system testing of ten transmitters and receivers on-time and within budget. Up to eight of the ten units are available for placement in schools

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GLOBE/PORTCOM

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participating in the program. Both the transmitter and receiver have demonstrated error free performance at data rates of 4.8Kbps with 1/2 rate convolutional encoding (9.6Ksps). The transmitter uses a three inch diameter antenna in conjunction with a one watt power amplifier.

The National Oceanic and Atmospheric Administration (NOAA) is funding the construction of a transmitter unit to use in testing as part of their ocean buoy program in the Pacific Ocean.

One of the transmitters was used at GSFC during the "Take Your Daughter to Work" day activities. A group photograph was formatted and transmitted via the Tracking and Data Relay Satellite (TDRS) to GSFC for processing and local display for the attendees.

A full scale demonstration of the transmitter and receiver was successfully accomplished on May 9, 1995 at NASA Headquarters. The Associate Administrator of the Office of Space Communications, and others, received a demonstration of the units from the roof of the Headquarters building. Image and data files were transmitted from the roof via the TDRS East satellite to the White Sands Complex (WSC) then relayed to the Packet Processor in Building 23 at GSFC via NASCOM. These data were reviewed for errors and reformatted for return to WSC and uplinked to TDRS. TDRS then transmitted a forward link signal to the GLOBE receiver on the roof at NASA Headquarters. The Associate Administrator was able to view transmission and reception of a color image file, and view it shortly after it was received.

Article by Lou Koschmeder

Coming Attractions

International Space Station Tests with Network

The International Space Station (ISS) Program Office (ISSPO) and McDonnell Douglas Aerospace are working with GSFC representatives to prepare for the first integrated test with the Space Network. The test is planned in July 1995 and will use the S-band Communication and Tracking (C&T) development models. The S-band test set will radiate to TDRS via the GSFC Compatibility Test Van (CTV) from the Lockheed-Martin Marietta S-band integration facility in Camden, New Jersey. The current S-band C&T test and verification plan is being reviewed. A new verification approach is being considered because the current plan integrates the flight hardware at the Kennedy Space Center (KSC) just two months prior to launch, which is too late to make significant changes. The ISSPO has been evaluating a recent proposal to perform TDRS capability tests on the RF Qualification Model (QM) Groups at the Rockwell International Seal Beach facility in July 1997.

Preparation for the first Ku-band integrated test with the Space Network has begun. The Ku-band developmental models will be tested with TDRSS as early as March 1996 also from Camden, New Jersey. The ISSPO is reviewing the plan to verify the Ku-band flight model test set with the TDRSS during acceptance testing at KSC two months prior to launch. The new proposed plan will verify TDRS compatibility using the Qualification Models nine months prior to launch. This compatibility test will utilize the GSFC CTV capability at the Rockwell International Seal Beach facility. The KSC test will be conducted to support system requirements prior to vehicle launch.

For additional information, please contact Ted Sobchak

RENAISSANCE Plans Architecture

The Renaissance Team has been very busy since the last SN Integrator newsletter. The working groups have been meeting regularly and several action items are currently open. Two drafts of the catalog for the first generation architecture building blocks have been completed and the development of the software database has been initiated.

In the operations area, the Renaissance capabilities library concept and the contents have been defined, and draft 1 of the telemetry operations and attitude determination operations activities has been completed. The process working group has completed a draft plan for cost estimating methods and is currently reviewing the latest version of the Process Guide, white papers on the Agent/Domain model, and configuration management for Renaissance. Also soon to be released is the repository definition of the relationship between

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RENAISSANCE

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operations concept scenarios, functions, architectures, and building blocks.

At the Systems Engineering level, much progress has been made in defining Renaissance standards and in supporting numerous outside activities. These activities include the EOS Data and Operations Systems (EDOS) replanning effort, the GSFC Code 500/700 Tiger Team on Mission Operations Center (MOC)/Science Operations Center/Integration and Test systems integration effort, MIDEX support at both the project and proposal levels, and new millennium support.

Finally, the Systems Engineering facility will shortly complete its telemetry front end prototyping work to support the Advanced Composition Explorer-MOC and Packet Processing Facility (PACOR) architecture and evaluation of its performance under standard UNIX versus VxWorks.

Finally, a major three month activity has just begun. We are trying to build a complete ground data system with as much COTS software as possible to meet the Solar, Anomalous, and Magnetosphere Particle Explorer (SAMPEX) mission requirements. We hope to learn first hand the problems associated with COTS integration, and plan for future strategies in this area. All in all, a very busy last three months, and even more so in the next three.

Article by Gary Meyers

STARLink To Send Image Data Over the Internet

The Satellite Telemetry and Return Link (STARLink) program through NASA Ames Research Center is continuing to plan for operations in late 1995. The ER-2 aircraft collects real time airborne science and disaster assessment information and transmits the data via TDRSS to customers in the field. The GSFC Mission Operations Division supplied a User Planning System (UPS) with the Payload Operations Control Center (POCC) at Ames Research Center. The POCC has been participating in testing over the past few months.

The STARLink Proof of Concept Test was conducted on April 17, 1995. The test generated science data at Salt Lake City, Utah which was successfully passed from the STARLink system through TDRS to White Sands, New Mexico. This data was then sent via STAT MUX to the STARLink POCC in California where it was converted to images in JPEG format and placed on the Internet for access. The test was declared a success with no problems encountered.

The STARLink Engineering Interface (EIF) test between the NCC and the STARLink POCC at Ames was also successful. Schedule adds, deletes, and error messages were checked individually and in bulk transmissions. Ground Control Message Request (GCMR) activity was conducted along with simultaneous scheduling activity and User Performance Data (UPD) traffic. Database inconsistencies were identified and resolved and new dual source codes for this POCC were exercised for the first time. The actual POCC personnel performed the interface testing with Goddard providing engineering support on site. The hardware and software installed at Ames is now fully capable of supporting operations.

A flight demonstration is scheduled for July 17 with an actual flight test occurring on July 19 for a few hours. The first official STARLink flight is scheduled for the end of October 1995. The images which are captured during the test and actual missions will be available via Internet at:
http://www.hawkeye.arc.gov

For additional information, please contact Greg Blaney

Space Network Workshop A'Comin'

The next Space Network Workshop is now in the planning stage. Some of the major topics identified for discussion will be:

- Cacique Upgrade Status
- Cacique Level 6 and Post Level 6 Test Plans
- SPSR Status
- TDRS H, I, and J
- Emerging Technologies for the Network

The workshop is tentatively scheduled for mid-October. If you have any ideas or suggestions for topics, please send them to:

lynn.myers@gsfc.nasa.gov

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Coming Attractions

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Automated Ground Network System (AGNS) Prepares for the Future

The NASA Ground Network (GN) has gradually evolved over the years to respond to new mission needs and accommodate new technologies. It has effectively satisfied mission requirements and has generated an enviable record of station availability and performance. However, this evolutionary process has resulted in a diverse collection of aging, custom equipment that is becoming increasingly more difficult and expensive to maintain.

The AGNS Project, managed by GSFC's Telecommunication Branch (Code 531), is utilizing modern technology advances toimplement improvements in the GN stations at Merritt Island, Ponce De Leon, and Bermuda. The AGNS will reduce life-cycle operating costs, improve station reliability, maintainability, and availability, and enable and enforce the use of internationally-recognized communications standards and protocols.

The AGNS Project implements an open, collaborative development environment, where developers and customers both contribute to design, development, implementation, and maintenance activities over wide area communications networks. By automating equipment operations and using expert systems to capture operations knowledge, the AGNS will reduce personnel peak work loads.

Initiated in November 1993 and scheduled for completion in November 1995, the AGNS Project will provide a flexible station architecture that can readily accommodate future requirements and technology updates with minimal cost and disruption to routine operations.

Article supplied by Peter Militch. For additional information, contact Miles Smith.

Technology Update

This new section of The Integrator will provide information on technology related to the Networks Division. Please feel free to make suggestions or submit articles for this area of interest.

Networks Division's Advanced Technology Initiatives in Support of Space Network Customers

The Networks Division has been conducting an aggressive Research and Development program, sponsored by NASA Headquarters/Office of Space Communications (Code O), in support of the growing community of TDRSS customers and an evolving network infrastructure. This article describes some of the recent technology developments, system engineering studies and applications engineering activities underway in the Networks Division in support of our Space Network (SN) customers. Additional articles will appear in future Integrator editions.

TDRSS Communications for Scientific Balloon Flights

June 1995 marks the first mission flight of the Long Duration Balloon Project using TDRSS communications. Two previous flight tests in September 1993 and August 1994 successfully validated the concept of TDRSS communications with high altitude, long duration scientific balloon flights made possible by the development of a low-cost, balloon-class TDRSS transponder for customer satellites. In addition to the dramatically lower cost, the Stanford Telecom transponder receiver achieves essentially instantaneous command channel acquisition of the TDRSS spread spectrum signal through the use of a unique charge coupled device (CCD) PN correlator chip developed for the Networks Division by MIT/Lincoln Laboratory. Other components of the LDBP's TDRSS communications system developed by the Networks Division are the quadrifilar helix flight antenna and the TDRSS User RF Test Set (TURFTS) - ground support equipment used to test the TDRSS communications system prior to launch. TURFTS' unique low-cost, advanced technology design has proven to be in great demand throughout the agency with units being built for Wallops, Marshall Space Flight Center, and Goddard Space Flight Center (EOS-AM, TRMM, Landsat-7, MIDEX, and the Simulation and Compatibility Test Branch RF Simulation Operations Center and

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TDRSS Communications

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Compatibility Test Vans).

Serendipitously, the in-house designed TURFTS equipment was quickly modified in 1993 by the Networks Division to serve as the prime customer service data receiver in the GRO Remote Terminal System (GRTS) in Australia, completing the global communications contingency coverage proved to the Compton Gamma Ray Observatory by the Space Network. In June, when the LDBP flight made its two-day drift through the former TDRSS zone-of-exclusion (ZOE), the data were relayed back by the very equipment designed to test it prior to launch.

TDRSS Communications for Remotely Piloted Aircraft

The next assignment for the balloon-class transponder, TURFTS and the quadrifilar helix flight antenna will be to demonstrate TDRSS communications with a remotely piloted aircraft in the fall of this year. Once validated, this will provide out of line-of-sight communications coverage for scientific aircraft in the NASA Ames Research Center atmospheric research program. A recent request for information from industry revealed some exciting prospects for significantly increasing the data rates by developing a directional S-Band antenna suitable for use by the aircraft.

For more information, contact:
David J. Zillig Head, RF Systems Section Code 531.2/GSFC (301) 286-8003 (301) 286-1724 - FAX
Email: David.J.Zillig@gsfc.nasa.gov

Look for more network news and activities in the GSFC Networks Division's home page on the World Wide Web (WWW).

(http://defiant.gsfc.nasa.gov/530homepage.html)

Milestone Updates

The SN/STGT Transition Major Milestone Chart (provided with this newsletter) has undergone some noticeable modifications. Its name has evolved to the SN/WSC Major Milestone Chart; it has been updated to reflect the completion of several activities; the current TDRS constellation for customer services is provided, and the focus is on the activities to complete the Cacique (WSGTU) Upgrade.

The NCCDS Major Milestone chart has been completed (with the successful completion of the Block 3 program) and has been deleted.

There are some changes with this newsletter.
If you have questions, comments, or suggestions for The Integrator newsletter, please contact:

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